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ABORTION, OR SLINKING THE CALF.^a

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Technically, abortion is the term used for the expulsion of the offspring before it can live out of the womb. Its expulsion after it is capable of an independent existence is premature parturition. In the cow this may be after seven and one-half months of pregnancy. Earl Spencer failed to raise any calf born before the two hundred and forty-second day. Dairymen use the term abortion for the expulsion of the product of conception at any time before the completion of the full period of a normal pregnancy, and in this sense it will be employed in this article.

Abortion in cows is either contagious or noncontagious. It does not follow that the *contagium* is the sole cause in every case in which it is present. We know that the organized germs of contagion vary much in potency at different times, and that the animal system also varies in susceptibility to their attack. The germ may therefore be present in a herd without any manifest injury, its disease-producing power having for the time abated considerably, or the whole herd being in a condition of comparative insusceptibility. At other times the same germ may have become so virulent that almost all pregnant cows succumb to its force, or the herd may have been subjected to other causes of abortion which, though of themselves powerless to actually cause abortion, may yet so predispose the animals that even the weaker germ will operate with destructive effect. In dealing with this disease, therefore, it is the part of wisdom not to rest satisfied with the discovery and removal of one specific cause, but rather to exert oneself to find every existent cause and to secure a remedy by correcting all the harmful conditions.

^a Reprint from Special Report on Diseases of Cattle, 1904.

CAUSES OF NONCONTAGIOUS ABORTION.

As abortion most frequently occurs at those three-week intervals at which the cow would have been in heat if nonpregnant, we may assume a predisposition at such times due to a periodicity in the nervous system and functions. Poor condition, weakness, and a too watery state of the blood is often a predisposing cause. This in its turn may result from poor or insufficient food, from the excessive drain upon the udder while bearing the calf, from the use of food deficient in certain essential elements, like the nitrogenous constituents or albuminoids, from chronic wasting diseases, from roundworms or tapeworms in the bowels, from flatworms (flukes, trematodes) in the liver, from worms in the lungs, from dark, damp, unhealthy buildings, etc. In some such cases the nourishment is so deficient that the fetus dies in the womb and is expelled in consequence. Excessive loss of blood, attended as it usually is by shock, becomes a direct cause of abortion.

Acute inflammations of important organs are notorious causes of abortion, and in most contagious fevers (lung plague, rinderpest, foot-and-mouth disease) it is a common result. Affections of the chest which prevent due aëration of the blood induce contractions of the womb, as shown experimentally by Brown-Sequard. Pregnant women suffocated in smoke aborted in many cases.^a

Chronic diseases of the abdominal organs are fertile sources of abortion, especially those that cause bloating (tympany of the first stomach) or diarrhea, or the diseases of the ovaries, kidneys, or bladder. The presence of gravel, or stone, in the kidneys, bladder, or urinary canals is an especial predisposing or even an exciting cause in magnesian limestone districts and in winter. The presence of tubercles in the ovaries, the broad ligaments of the womb, and even on the outer surface of the womb itself, must be added as efficient causes.

Fatty degeneration of the heart, a common disease in old cows of improved beef breeds, lessens the circulation in the placenta (and fetus) and, arresting nutrition, may cause abortion.

Indigestions of all kinds are especially dangerous, as they are usually associated with overdistention of the first stomach (paunch) with gas. As this stomach lies directly beneath and to the left side of the womb, any disorder, and above all an excessive distention of that organ, presses on or affects the womb and its contents dangerously. It further causes contractions of the womb by preventing aëration of the blood. Hence, all that tends to indigestion is to be carefully guarded against. Privation of water, which hinders rumination and digestion; ice-cold water, which rouses the womb to contraction and the calf to vigorous movement; green, succulent grass, to which the cow

^aRetoul.

has been unaccustomed; clover, which has just been wet with a slight shower; all green food, roots, potatoes, apples, pumpkins that are or have been frozen, or that are simply covered with hoar frost; food that has been grown in wet seasons or that has been badly harvested; growing corn, oats, etc., if the animal is unused to them; a too dry food or a too stimulating food (wheat bran, pease, maize, and cotton seed) fed too lavishly may, any one of them, induce abortion. The dry and stimulating foods last named bring on constipation with straining, and also elevated temperature of the body, which, in itself, endangers the life of the fetus.

Putrid, stagnant water is hurtful both to digestion and the fetus, and abortions in cows have been repeatedly traced to this source and have ceased when pure water was supplied. Ergoted grasses have long been known as a cause of widespread abortion in cows. The ergot is familiar as the dark purple or black, hard, spur-like growths which protrude from the seeds of the grasses at the period of their ripening. It is especially common in damp localities and cloudy seasons on meadows shaded by trees and protected against the free sweep of the winds. The same is to a large extent true of smut. Hence, wet years have been often remarkable for the great prevalence of abortions. Abortions have greatly increased in New Zealand among cows since the introduction of rye grass, which is specially subject to ergot. As abortion is more prevalent in old dairying districts, the ergot may not be the sole cause in this instance.

The smut of maize, wheat, barley, and oats is fostered by similar conditions and is often equally injurious. It should be added that the ergots and smuts of certain years are far more injurious than those of others. This may be attributed to the fact that they have grown under different conditions, and therefore have developed somewhat different properties, a habit of fungi which has been often observed, or that in certain seasons the cows have been more powerfully predisposed by other operative causes of abortion.

Both ergot and smut vary in potency according to the stage of growth. Doctor Kluge found that the ergot gathered before the grain had fully ripened was much more powerful than that from the fully ripened grain. McGugen found the ergot of wheat more potent than that of rye. It should be added that both ergot and smut are robbed somewhat of their deleterious properties if fed with an abundance of water, so that they may prove harmless if fed with roots, ensilage, etc., whereas they will prove hurtful when fed in the same amount with dry hay. They are also more liable to injure if fed for a long time in succession in winter, though it may be in smaller quantity.

Rust is also charged with causing abortions.^a That other cryptogams found in musty fodder are productive of abortion has been

^a Gerlach, Haselbach.

well established. In Germany and France the wet years of 1851, 1852, and 1853 were notorious for the prevalence of abortions.^a Fodders harvested in such seasons are always more or less musty, and musty hay and grain have been long recognized as a prolific cause of digestive, urinary, and cerebral disorders. Impactions and bloatings of the stomachs, excessive secretion of urine (diuresis), and red water are common results of such musty fodder, and we have already seen that such disorders of the digestive and urinary organs are very liable to affect the pregnant womb and induce abortion.

The riding of one another by cows is attended by such severe muscular exertion, jars, jolts, mental excitement, and gravitation of the womb and abdominal organs backward that it may easily cause abortion in a predisposed animal.

Keeping in stalls that slope too much behind (over 2 inches) acts in the same way, the compression due to lying and the gravitation backward proving more than a predisposed cow can safely bear.

Deep gutters behind the stalls, into which one or both hind limbs slip unexpectedly, strain the loins and jar the body and womb most injuriously. Slippery stalls in which the flooring boards are laid longitudinally in place of transversely, and on which no cleats or other device is adopted to give a firm foothold, are almost equally dangerous. Driving on icy ground or through a narrow doorway where the abdomen is liable to be jammed are other common causes. Offensive odors undoubtedly cause abortion. To understand this one must take into account the preternaturally acute sense of smell possessed by cattle. By this sense the bull instantly recognizes the pregnant cow and refrains from disturbing her, while man, with all his boasted skill and precise methods, finds it difficult to come to a just conclusion. The emanations from a cow in heat, however, will instantly draw the bull from a long distance. Carrion in the pasture fields or about slaughterhouses near by, the emanations from shallow graves, dead rats or chickens about the barns, and dead calves, the products of prior abortions, are often chargeable with the occurrence of abortions. Aborting cows often fail to expel the afterbirth, and if this remains hanging in a putrid condition it is most injurious to pregnant cows in the near vicinity. So with retained afterbirth in other cows after calving. That some cows kept in filthy stables or near-by slaughterhouses may become inured to the odors and escape the evil results is no disproof of the injurious effects so often seen in such cases.

The excitement, jarring, and jolting of a railroad journey will often cause abortion, especially as the cow nears the period of calving, and the terror or injury of railway or other accidents prove incomparably worse.

^a Baumeister, Rueff, Rondaud, Trelut.

All irritant poisons cause abortions by the disorder and inflammation of the digestive organs, and if such agents act also on the kidneys or womb, the effect is materially enhanced. Powerful purgatives or diuretics should never be administered to the pregnant cow.

During pregnancy the contact of the expanding womb with the paunch, just beneath it, and its further intimate connection through nervous sympathy with the whole digestive system, leads to various functional disorders, and especially to a morbid craving for unnatural objects of food. In the cow this is shown in the chewing of bones, pieces of wood, iron bolts, articles of clothing, lumps of hardened paint, etc. An unsatisfied craving of this kind, producing constant excitement of the nervous system, will strongly conduce to abortion. How much more so if the food is lacking in the mineral matter, and especially the phosphates necessary for the building up of the body of both dam and offspring, to say nothing of that drained off in every milking. This state of things is present in many old dairy farms, from which the mineral matters of the surface soil have been sold off in the milk or cheese for generations and no return has been made in food or manure purchased. Here is the craving of an imperative need, and if it is not supplied the health of the cow suffers and the life of the fetus may be sacrificed.

Among other causes of abortion must be named the death or the various illnesses of the fetus, which are about as numerous as those of the adult; the slipping of a young fetus through a loop in the navel string so as to tie a knot which will tighten later and interrupt the flow of blood with fatal effect, and the twisting of the navel string by the turning of the fetus until little or no blood can flow through the contorted cord. There is in addition a series of diseases of the mucous membrane of the womb, and of the fetal membranes (inflammation, effusion of blood, detachment of the membranes from the womb, fatty or other degenerations, etc.), which interfere with the supply of blood to the fetus or change its quality so that death is the natural result, followed by abortion.

CAUSE OF CONTAGIOUS ABORTION.

While any one of the above conditions may concur with the contagious principle in precipitating an epizootic of abortion, yet it is only by reason of the *contagium* that the disease can be indefinitely perpetuated and transferred from herd to herd. When an aborting cow is placed in a herd that has hitherto been healthy, and shortly afterwards miscarriage becomes prevalent in that herd and continues year after year, in spite of the fact that all the other conditions of life in that herd remain the same as before, it is manifest that the result is due to contagion. When a bull, living in a healthy herd, has been

allowed to serve an aborting cow, or a cow from an aborting herd, and when the members of his own herd subsequently served by him abort in considerable numbers, contagion may be safely inferred. Mere living in the same pasture or building does not convey the infection. Cows brought into the aborting herd in advanced pregnancy carry their calves to the full time. But cows served by the infected bull, or that have had the infection conveyed by the tongue or tail of other animals, or by their own, or that have had the external genitals brought in contact with wall, fence, rubbing post, litter, or floor previously soiled by the infected animals, will be liable to suffer. The Scottish abortion committee found that when healthy, pregnant cows merely stood with or near aborting cows they escaped, but when a piece of cotton wool lodged for twenty minutes in the vagina of the aborting cow was afterwards inserted into the vagina of a healthy pregnant cow or sheep, these latter invariably aborted within a month. So Roloff relates that in two large stables at Erfurt, without any direct intercommunication, but filled with cows fed and managed in precisely the same way, abortion prevailed for years in the one, while not a single case occurred in the other. Galtier finds that the virus from the aborting cow causes abortions in the sow, ewe, goat, rabbit, and guinea pig, and that if it has been intensified by passing through either of the two last-named animals it will affect also the mare, bitch, and cat.

It does not appear that it is always the same organism which causes contagious abortion. In France, Nocard found in the aborting membranes and the mucous membrane cocci, or globular bodies, singly or in chains, and a very delicate rod-shaped organism by which the disease was propagated and which survived in the womb through the interval between successive pregnancies. The Scottish commission found as many as five separate kinds of bacteria. Bang, in Denmark, found a very delicate rod-shaped organism showing its most active growth at two different depths in nutrient gelatin, and which produced abortion in twenty-one days when inoculated on the susceptible pregnant cow. In America, Chester, of Delaware, and Moore, of New York, constantly found organisms differing somewhat in the two States, but evidently of the same group with the colon germ (*Bacillus coli communis*). These were never found in the healthy pregnant womb, but in the cow that had aborted they continued to live in that organ for many months after the loss of the fetus.

We may reasonably conclude that any microorganism which can live in or on the lining membrane of the womb producing a catarrhal inflammation, and which can be transferred from animal to animal without losing its vitality or potency, is of necessity a cause of contagious abortion. As viewed, therefore, from the particular germ that may be present, we must recognize not one form only of conta-

gious abortion, but several, each due to its own infecting germ, and each differing from others in minor particulars, like duration of incubation, infection of the general system, and the like. In Europe the germs discovered seem to affect the general system much more than do those found in America. Bang's germ caused abortion in twenty-one days; the New York germ, inoculated at service, often fails to cause abortion before the fifth or seventh month.

Symptoms of abortion.—As occurring during the first two or three months of gestation, symptoms may escape detection, and unless the aborted product is seen the fact of abortion may escape notice. Some soiling of the tail with mucus, blood, and the waters may be observed or the udder may show extra firmness, and in the virgin heifer or dry cow the presence of a few drops of milk may be suggestive, or the fetus and its membranes may be found in the gutter or elsewhere as a mere clot of blood or as a membranous ball in which the forming body of the fetus is found. In water the villi of the outer membrane float out, giving it a characteristically shaggy appearance.

In advanced pregnancy abortion is largely the counterpart of parturition, so that a special description is superfluous. The important thing is to distinguish the early symptoms from those of other diseases, so that the tendency may be arrested and the animal carried to full time if possible. A cow is dull, sluggish, separate from the herd, chewing the cud languidly, or there may be frequent lying down and rising, uneasy movements of the hind feet or of the tail, and slightly accelerated pulse and breathing and dry muzzle. The important thing is not to confound it with digestive or urinary disorders, but in a pregnant cow to examine at once for any increase of mucus in the vagina, or for blood or liquid there or on the root of the tail; for any enlargement, firmness, or tenderness of the udder; or in dry cows examine for milk; and above all for any slight straining suggestive of labor pains.

In many cases the membranes are discharged with the fetus; in others, in advanced pregnancy, they fail to come away, and remain hanging from the vulva, putrefying and falling piecemeal, finally resulting in a fetid discharge from the womb. According to the size of the herd, contagious abortions will follow one another at intervals of one to four or more weeks, in the order of their infection or of the recurrence of the period of activity of the womb which corresponds to the occurrence of heat.

Prevention.—Weakness and bloodlessness are to be obviated by generous feeding, and especially in aliments (wheat bran, rape cake, cotton seed, oats, barley, beans, pease, etc.), rich in earthy salts, which will also serve to correct the morbid appetite. This will also regenerate the exhausted soil if the manure is returned to it. In the same way the application of ground bones or phosphates will correct

the evil, acting in this case through the soil first and raising better food for the stock. The ravages of worms are to be obviated by avoiding infested pastures, ponds, streams, shallow wells, or those receiving any surface leakage from land where stock go, and by feeding salt at will, as this agent is destructive to most young worms.

The tendency to urinary calculi in winter is avoided by a succulent diet (ensilage, steamed food, roots, pumpkins, apples, potatoes, slops), and by the avoidance of certain special causes. Furnishing water inside the barn in winter in place of driving once a day to take their fill of ice-cold water will obviate a common evil. Putrid and stagnant waters are to be avoided. Sudden changes of food are always reprehensible, but much more so in the pregnant animal. Let the change be gradual. Carefully avoid the use of spoiled or unwholesome food.

In case of prevalence of ergot in a pasture it should be kept eaten down or cut down with a mower, so that no portion runs to seed. In case of a meadow, the grass must be cut early before the seeds have filled. The most dangerous time appears to be between the formation of the milky seed and the full ripening. Yet the ergot is larger in proportion to the ripeness, so that the loss of potency is made up in quantity. The ripe seed and ergot may be removed by thrashing and the hay safely fed. It may also be noted that both ergot and smut may be safely fed in moderate quantity, provided it is used with succulent food (ensilage, roots, etc.), or with free access to water, and salt is an excellent accessory as encouraging the animal to drink. Both ergot and smut are most injurious in winter, when the water supply is frozen up or accessible only at long intervals. The ergoted seed, when thrashed out, can not be safely sown, but if first boiled it may be fed in small amount or turned into manure. The growth of both ergot and smut may be to a large extent prevented by the time-honored Scotch practice of sprinkling the seed with a saturated solution of sulphate of copper before sowing.

Fields badly affected with ergot, or smut, may be practically renewed by plowing up and cultivating for a series of years under crops (turnips, beets, potatoes, buckwheat, etc.) which do not harbor the fungus and which require much cultivation and exposure of the soil. Drainage and the removal of all unnecessary barriers to the free action of sunshine and wind are important provisions.

Other precautions concerning separation from cows in heat—a proper construction of stalls, the avoidance of carrion and other offensive odors, protection from all kinds of mechanical injuries, including overdriving and carrying by rail in advanced pregnancy, the exclusion of all irritants or strong purgatives and diuretics from food or medicine, and the guarding against all causes of indigestion and bloating—have been sufficiently indicated under “Causes.”

For protection of the womb and fetus against the various causes of disease, available methods are not so evident. For cows that have aborted in the last pregnancy, chlorate of potash, 3 drams daily before the recurrence of the expected abortion, has been held to be useful.

TREATMENT OF NONCONTAGIOUS ABORTION.

Although the first symptoms of abortion have appeared, it does not follow that it will go on to completion. So long as the fetus has not perished, if the waters have not been discharged, nor the water bags presented, attempts should be made to check its progress. Every appreciable and removable cause should be done away with, the cow should be placed in a quiet stall alone, and agents given to check the excitement of the labor pains. Laudanum in doses of 1 ounce for a small cow or 2 ounces for a large one should be promptly administered and repeated in three or four hours, should the labor pains recur. This may be kept up for days or even weeks, if necessary, though that is rarely required, as the trouble either subsides or abortion occurs. If the laudanum seems to lack permanency of action, use bromide of potassium, or, better, extract of *Viburnum prunifolium* (40 grains), at intervals of two or three hours until five or six doses have been given.

PREVENTION AND TREATMENT OF CONTAGIOUS ABORTION.

So far as this differs from the treatment of sporadic abortion, it consists in separation and the free use of germicides or disinfectants.

(1) Separate all aborting cows in isolated building, yards, and pasture, allowing no other cows to have access even to their manure, liquid or solid. Not even breeding ewes, goats, sows, rabbits, or mares should be allowed to go from the isolated to the noninfected premises. Separate attendants and utensils are desirable.

(2) Scrape and wash the back part of the stall and gutter and water it with a solution of 5 ounces sulphate of copper (bluestone) in 1 gallon pure water. Repeat this cleaning and watering at least once a week. This should in all cases be applied to every stall where an aborting cow has stood and to those adjacent. To treat the whole in the same way would be even better, as it is impossible to say how many of the cows harbor the germ. This is the more needful as that in one to three years, if the aborting cow is kept on, she becomes insusceptible and carries her calf to full time. A cow may therefore be infecting to others though she herself no longer aborts.

(3) Dissolve 1 dram corrosive sublimate, 1 ounce each of alcohol and glycerine, and shake this up in a gallon of water, to use as an injection into the vagina and a wash for the parts about the vulva and root of the tail. Being very poisonous, it should be kept in a wooden

barrel out of the way of animals or children. Every morning the vulva, anus, back of the hips, and root of the tail should be sponged with this liquid, and this is best applied to the whole herd. A 1 per cent solution of carbolic acid is a good substitute.

(4) When any case of abortion has occurred the fetal membranes must be removed by the hand without delay, and, together with the fetus, destroyed by burning or boiling, or buried deeply, and the stall should be cleansed and watered freely with the copper solution. Then the womb should be washed out with $1\frac{1}{2}$ gallons of the corrosive sublimate solution injected through a rubber tube introduced to the depth of the womb and with a funnel in its outer elevated end. This should be repeated daily for a week. In the case of the other non-pregnant cows of the herd one injection of the same kind should be made into the vagina, after which they need only have their external parts and tail washed with the solution daily.

(5) Do not breed aborting cows for two or three months, then use a separate bull, injecting his sheath and washing his belly before and after each service with the carbolic-acid solution. Exclude all outside cows from service by the regular herd sire and, in purchasing breeding animals, subject them to quarantine and treatment before placing them in the sound herd.

As a certain number of the cows will harbor the germ in the womb when treatment is started, it is not to be expected that abortions will cease at once, but by keeping up the treatment the trouble may be got rid of in the following year. As an aborting cow is usually of little use for the dairy, it is best to separate and fatten her and apply treatment to those that remain. In this, as in other delicate manipulations, the stock owner will consult his own interest by employing an accomplished veterinarian and avoiding such as have not had the privileges of a thorough professional education. In addition to the above, the removal of all manure and contaminated litter and the sprinkling of the surface with the sulphate of copper solution is called for. Drains should no less be thoroughly rinsed and disinfected. Milking stools and other implements may be treated in the same way, or with carbolic acid or boiling water. Great care should be taken to guard against bull or cows from an aborting herd or district; streams even may be suspected if there is an aborting herd near by and higher up on that stream. Cows sent to bull from an aborting herd are to be positively denied, and workmen that have attended on such a herd should be required to wash and disinfect their clothes and persons.

NOTE.—It is impossible to lay too much stress on the importance of protecting a sound herd against contagious abortion rather than of treating animals already diseased. This consists principally in purchasing animals from clean herds only, in isolating all new purchases and in not breeding to them until they

have been proved free from infection, or in disinfecting the genitals of all newly acquired animals for at least a week.

In cases where it is desired to treat pregnant cows to prevent them from aborting, hypodermic injections of 2 drams of a 2 per cent solution of carbolic acid every two weeks until eight injections have been given, may be tried, but too much success should not be expected from this treatment. The most suitable place for the injection is on the side of the neck. Range cattle may be more readily treated by the use of medicated salt placed in troughs accessible to the animals. This salt is easily prepared by pouring 4 ounces of liquefied crude carbolic acid upon 12 quarts of ordinary barrel salt, after which they are thoroughly mixed.

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